Review of "Assessing the potential efficacy of marine cloud brightening for cooling Earth using a simple heuristic model" by Wood (acp-2021-327)

The manuscript investigates the potential of marine cloud brightening (MCB), a geoengineering approach to mitigate global warming by the artificial seeding of clouds with sea salt aerosols to increase their albedo. By developing and applying a heuristic MCB model, the author is able to constrain the effect of various important MCB parameters (the total mass of injected aerosol, the size of the injected aerosol particles, and their number). After that, the author uses these results to discuss implications for other fields currently involved in assessing and developing potential MCB projects (engineering, climate modeling, and large-eddy simulations).

Considering the increasing interest in MCB, not only in science but also in governmental and non-governmental organizations, this manuscript is highly relevant. Moreover, it is very interesting, well-written, and I have only very minor comments, which the author may want to consider. Accordingly, I do not need to see the manuscript again and fully support its publication in *Atmospheric Chemistry and Physics*.

Minor Comments

Ll. 47 – 49: A recent paper by Glassmeier et al. (2021) vividly illustrates that the sign of LWP adjustments depends not only on the meteorological conditions but also on the number of aerosol particles, causing positive adjustments when the aerosol number is small and negative adjustments when the aerosol number is large. While I agree that the magnitude of these negative adjustments is probably meteorology dependent, the general trend caused by the number of aerosol particles is probably very relevant to the efficiency of MCB. Therefore, I suggest a short discussion of this effect.

Ll. 49 – 51: Shortly before Ackerman et al. (2004), Wang et al. (2003) also discussed negative LWP adjustments.

Ll. 63 – 65, 620 – 630: In all discussed MCB spraying apparatus, seawater droplets and not aerosol particles are injected into the atmosphere. Since the seawater droplets are slightly larger than aerosol particles, Brownian coagulation might be slower than estimated here.

Ll. 177 – 187: While I believe that I understand what the author is doing here, the last sentence confuses me. I assume that Eq. (4) results from an optimization problem based on MODIS data but not fitting satellite observations. Please clarify.

Ll. 279 – 301: Choosing a Poisson distribution to parameterize track overlap is probably the right choice. However, as long as the spraying vessels do not move, I would assume that tracks are parallel since they are all inside the same boundary layer. Of course, these tracks might overlap if a spraying vessel is directly leeward of a second.

L. 293: Maybe one should note that *n* is integer.

Ll. 473 – 474: I assume the generally larger size of natural sea spray particles is responsible for their shorter lifetime compared to injected sea salt particles. One should state this clearly.

Technical Comments

L. 166: I assume that this should be ϕ_{atm} and not f_{atm}.

References

Ackerman, A. S., Kirkpatrick, M. P., Stevens, D. E., & Toon, O. B. (2004). The impact of humidity above stratiform clouds on indirect aerosol climate forcing. *Nature*, *432*(7020), 1014-1017.

Glassmeier, F., Hoffmann, F., Johnson, J. S., Yamaguchi, T., Carslaw, K. S., & Feingold, G. (2021). Aerosol-cloud-climate cooling overestimated by ship-track data. *Science*, *371*(6528), 485-489.

Wang, S., Wang, Q., & Feingold, G. (2003). Turbulence, condensation, and liquid water transport in numerically simulated nonprecipitating stratocumulus clouds. *Journal of Atmospheric Sciences*, *60*(2), 262-278.